

Real-Time Control of Combined Sewer Networks

Mary K. Stinson • Urban Watershed Management Branch, Water Supply and Water Resources Division
National Risk Management Research Laboratory, U. S. Environmental Protection Agency, Edison, New Jersey

WHAT IS RTC?

Real-time control (RTC) is a custom- designed management program for a specific urban sewerage system that is activated during a wet-weather event.

RTC FUNCTIONS

- Route flows in-line, off-line, to treatment plant, designated points
- Control flood, overflows (CSOs, SSOs), surcharge
- Maximize storage space
- Optimize treatment plant capacity
- Prevent operational problems
- Protect /restore receiving waters

REGULATORY SUPPORT

- U.S. EPA National CSO Control Policy’s 9 Minimum Controls (meets storage requirement)
- CSO Long Term Control Plan (implementation)
- SSO control (implementation)
- Total watershed restoration and/or protection approach (implementation)

COST-SAVING FEATURE

- A new RTC system, hardware and software, costs from \$10 to \$40 million. (RTC in Vienna, under construction, may cost over \$30 million).
- RTC upgrades are much less expensive than new systems.
- U.S. conventional storage needs are estimated at \$10s of billions.
- For a given sewerage system, RTC system costs 50 to 75% of storage construction cost. (RTC in Quebec City was estimated at \$34 million against storage alone at \$44 million).
- Millions of dollars in savings come from RTC operation that maximizes storage.

RTC HARDWARE

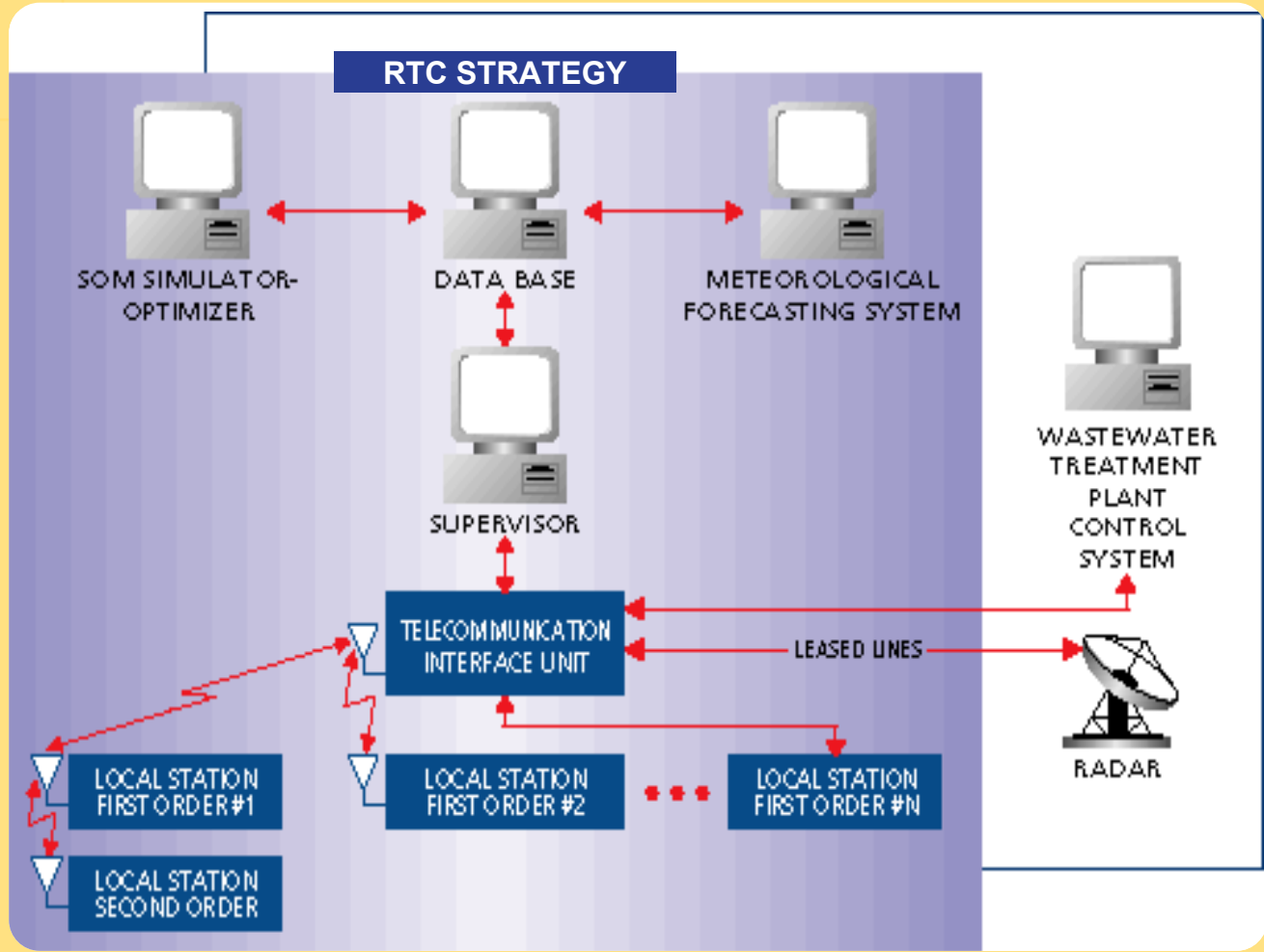
1. Measurement devices
 - Flow
 - Water level
 - Rainfall intensity
 - Pollutant concentration
2. Regulators
 - Pumps
 - Movable gates
 - Movable weirs
3. Communication
 - Public dial telephone
 - Dedicated lines
4. Controllers and
 - Process Computers
 - PID
 - SCADA systems
 - Limit switch
 - PLC
 - Radio frequencies

CITIES with RTC

U.S.	Europe
Chicago	Antwerp
Cincinnati	Barcelona
Cleveland	Copenhagen
Detroit	Malmo
Indianapolis	Paris
Milwaukee	Vienna
Louisville	Zurich
Philadelphia	Japan
St. Paul	Tokyo
Seattle	
Canada	
Edmonton	
Montreal	
Quebec City	
St. Catherine	

RTC SYSTEM COMPONENTS

Equipment - “Hardware”
Control strategies - “Software”
Incorporation into sewerage operation - “Management”
(Recent advancements in the durability of “Hardware” and significant developments in the “Software” and “Management” components).

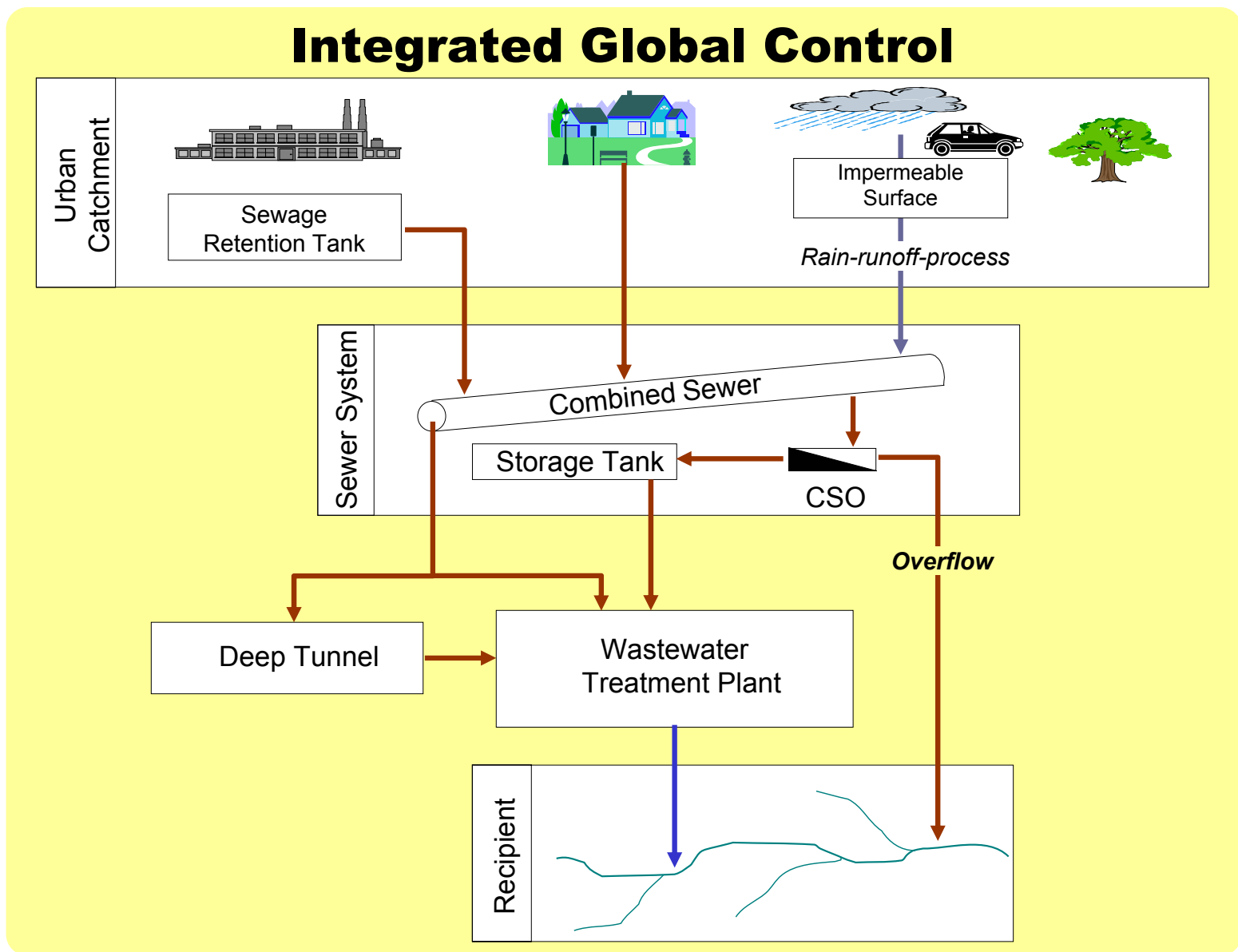


RTC MANAGEMENT (SOFTWARE)

1. Principal alternatives: Local Controls - many types (better performance at single sites)
2. Global Control - supervisory or automated – (always better performance than with local controls)

INTEGRATED GLOBAL CONTROL

- Uses weather forecast in flow routing strategy - prepares ahead for a flow event.
- Maximizes storage space in- and off-line.
- Eliminates in-line surcharges to prevent basement flooding or conduit damages.
- Delivers optimal loads to treatment plant(s).
- Protects receiving waters by prevention/control of untreated overflows.
- Directs unavoidable overflows to less sensitive receiving waters.
- Protects all system components from damages by preventing failures and downtime.

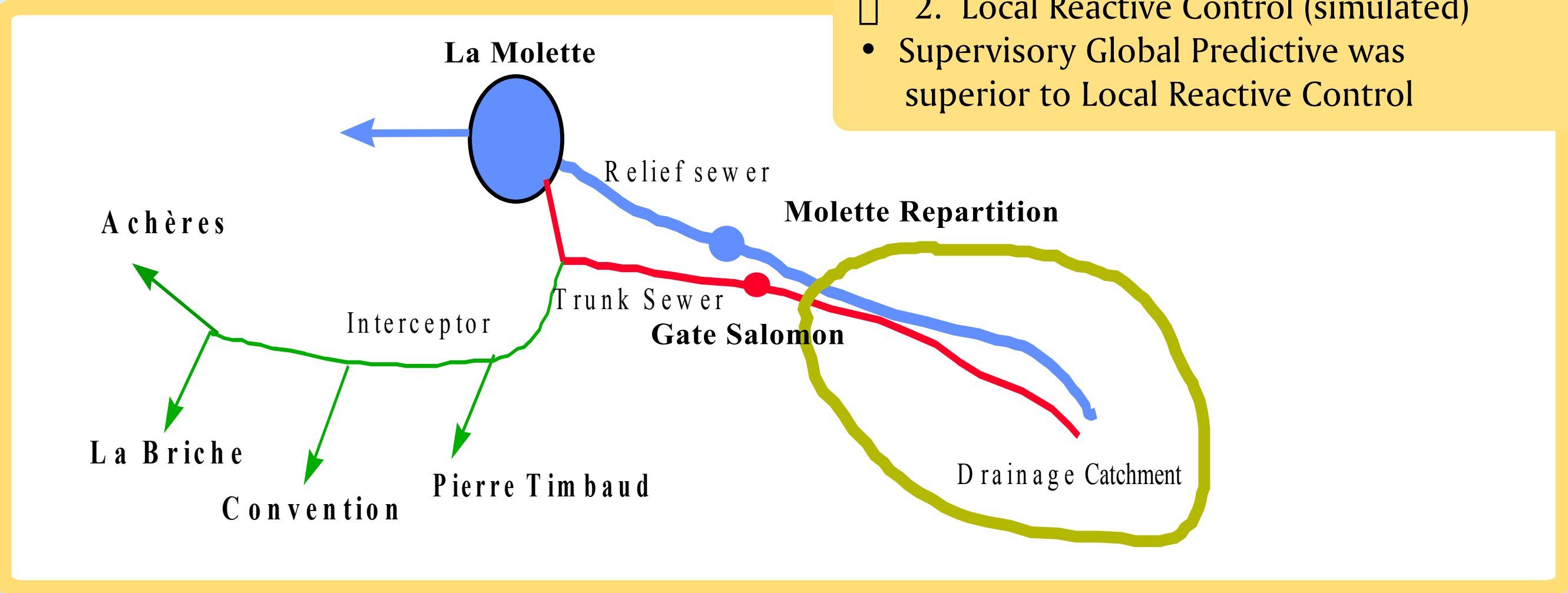


U.S. EPA RTC RESEARCH

- Eight completed projects: 1969 – present
- Recently completed projects at:
 - 1. Seine-Saint-Denis, Paris Metro, France
 - 2. Quebec City, Quebec, Canada
- Ongoing project at: Milwaukee Metropolitan Sewerage District (MMSD), Milwaukee, Wisconsin

SEINE-SAINT-DENIS SITE

- Two RTC alternatives were compared:
 - 1. Supervisory Global Predictive (in use)
 - 2. Local Reactive Control (simulated)
- Supervisory Global Predictive was superior to Local Reactive Control

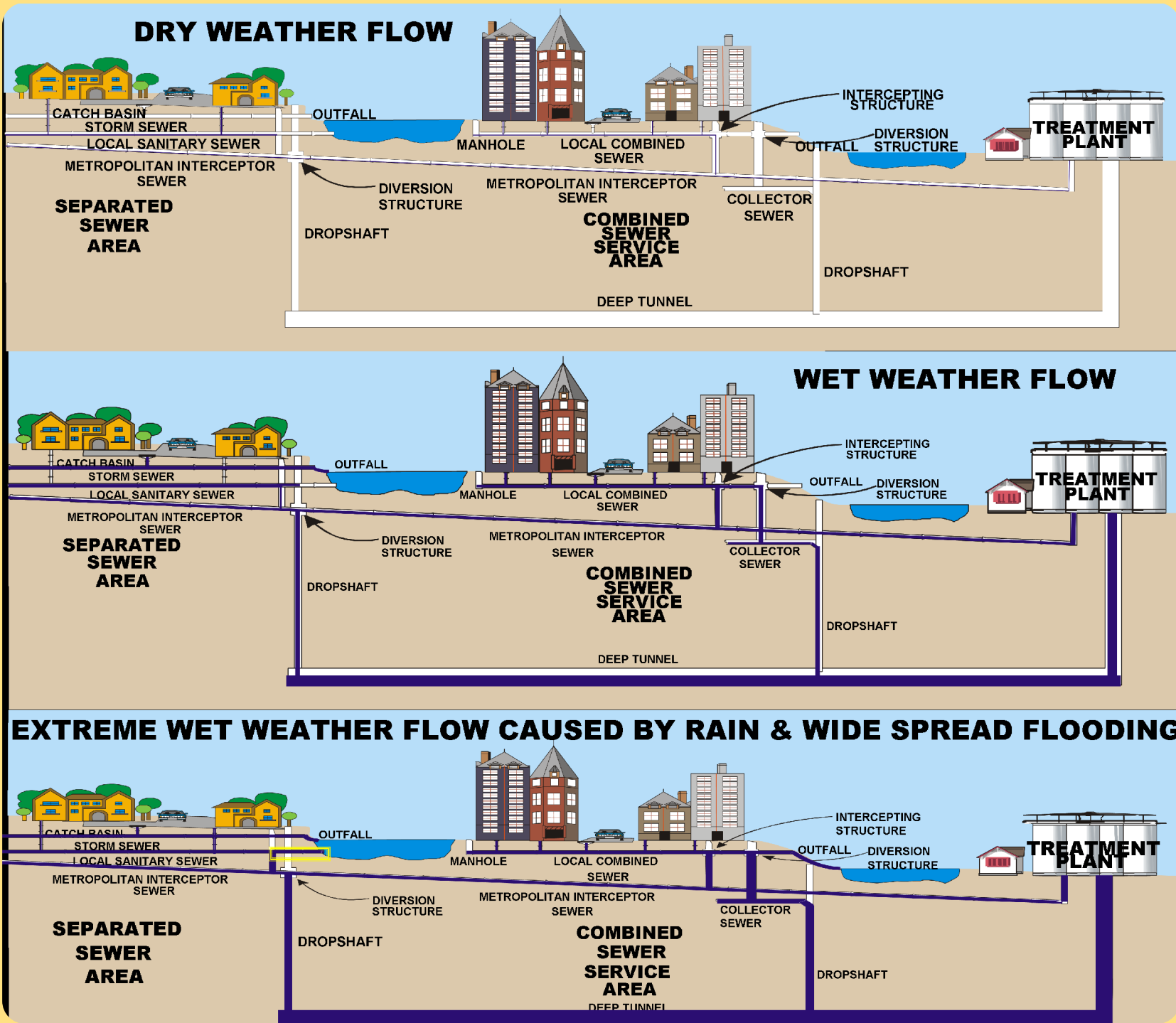
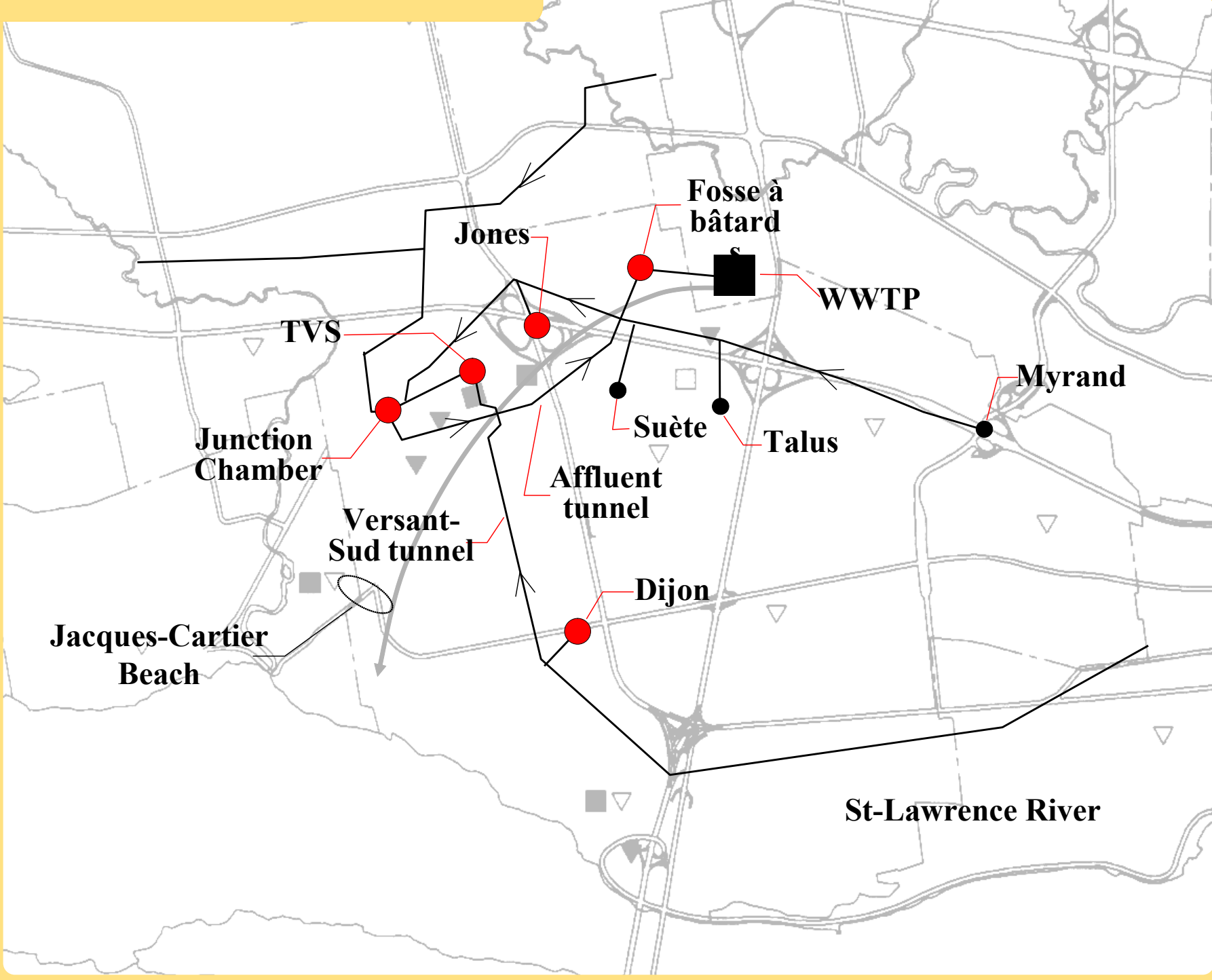


QUEBEC CITY STUDY

- Three RTC alternatives compared by simulation to static control:
 1. Local Reactive Control (LRC) (Type 1)
 2. Local Reactive Control (LRC) (Type 2)
 3. Optimal Global Predictive (OGP)

QUEBEC CITY STUDY RESULTS

- All RTCs worked better than static control
- OGP RTC and LRC Type 2 were similar in performance and cost
- OGP RTC fulfilled all design objectives while LRC Type 2 did not



MILWAUKEE METROPOLITAN SEWERAGE DISTRICT

- Ongoing U.S. EPA study evaluates performance and cost effectiveness of a complex, integrated RTC system at MMSD
- Memorandum of Understanding between MMSD and U.S. EPA provides access to:
 - 1. the system itself
 - 2. historical and current operational data
 - 3. interaction with operating personnel
- Completion date is April, 2006